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CHAPTER I -- DESIGN OBJECTIVES OF THE WEAPON PROGRAM

General

[redacted] The TX-53 bomb and basic assembly are intended for application in SAC bomber aircraft (B-47, B-52, B-58, and B-70*) in the following delivery options:

- High altitude delivered free fall air burst
- High altitude delivered free fall contact burst
- High altitude delivered retard air burst (except B-58)
- High altitude delivered retard contact burst (except B-58)
- Low altitude laydown delivery delayed burst.

The requirements derived from the Military Characteristics, Stockpile-to-Target Sequence and Ordnance Characteristics established by Sandia Corporation which dictated or influenced weapon design are outlined below.

Environmental Requirements

The weapon shall not be limited to any special storage environment and shall withstand, without damage, functional impairment, or reduction in reliability, the environment expected in the stockpile-to-target sequence (see Appendix B) with the exception of carriage in the B-70 aircraft (see Reference 9). To obtain an indication of the capability of the weapon to withstand the stockpile-to-target sequence, the weapon is required to withstand the applicable environmental tests specified in SC-4259(TR), Environmental Guide for Nuclear Ordnance Development.

The use of materials sensitive to radiation damage has been avoided in all components wherever possible, without serious compromise to other design requirements.

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*Because of the high cost of developing components compatible with the anticipated high temperature environment of the B-70, and because of the partial suspension and uncertainty of the B-70 program, development to thermally upgrade the TX-53 for B-70 application was discontinued as of January 1960. Sandia Corporation advised that the TX-53 thermal upgrading development could be resumed and completed on time scales compatible with the B-70 program if authorization is received on reasonable time scales.

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[redacted]

In the design of the TX-53, vulnerability to blast or fragment damage shall be minimized, and maximum protection aginst tampering or sabotage shall be afforded. [redacted] To meet this requirement, the basic assembly must be watertight.

The weapon is required to survive the impact loads associated with laydown.

Structural Requirements

The TX-53 structure is required to withstand loads imposed during handling, transportation, and flight, while being carried by the proposed carriers shown in Table I. After release from the carrier, the structure must withstand the aerodynamic loads, retardation parachute, laydown parachute loads, and impact loads.

Electrical System Requirements

The TX-53 is required to supply air burst, ground burst, and laydown delayed burst. These options shall be selectable in flight.

Compatibility Requirements

The TX-53 shall be compatible with the B-47 and B-52 bomb bays, including dual carriage in the B-52.

Safety Requirements

The probability of premature nuclear detonation from random component failures alone, for the environment specified, shall be less than the following:

1. Storage, transportation, handling, and maintenance of the bomb and the basic assembly in a completely assembled condition, 1 in 10^6.
2. After drop, where a nuclear detonation might endanger aircraft or crew (exclusive of parachute failure), 1 in 2000.

Visual indication of a safe or unsafe condition shall be provided during ground handling. Release of the bomb in the unarmed condition must result in a nuclear dud. The bomb must be capable of remote arming and safing by the T-249, and provide positive indication of the armed or safe condit... the crew's compartment. Following a normal armed release, all accessible weapon safety devices sh... interlocks to prevent a simple means of disabling the weapon.

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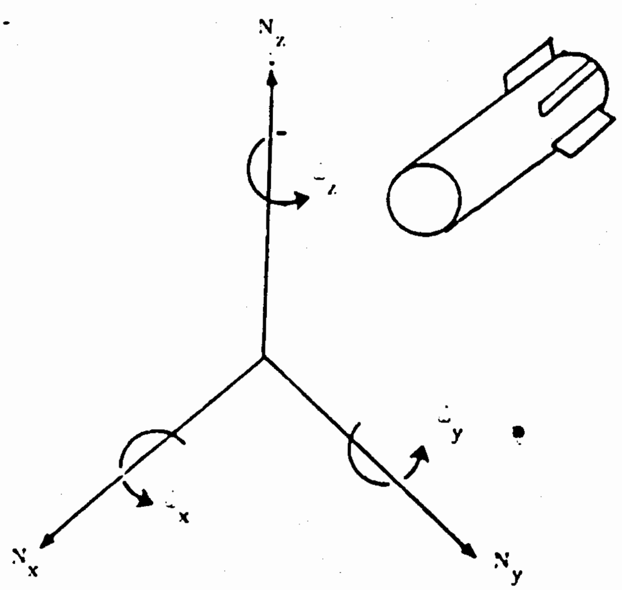
TABLE I

Design Loads

Condition	Inertia load factor (g) N_x	N_y	N_z	Angular acceleration (rad/sec²) ω_x	ω_y	ω_z
B-47 and B-52 flight and landing (limit) (applied in combination)	±1.5	±1.5	+2.0 -5.0	0	±2.5	0
Hoisting (limit) (applied singly)	0	0	-4.0			
Transport (limit) (applied singly)	±6.0	±2.0	+3.5 -4.5			
Air transport emergency (ultimate) (applied singly)	±8.0	0	-6.7			
Laydown - initial impact (ultimate) (applied in combination)	+70	$\sqrt{N_y^2 + N_z^2} = 50$				
Laydown - secondary impact (ultimate) (applied in combination)	-50	0				
	0	$\sqrt{N_y^2 + N_z^2} = 100$				
	$\sqrt{N_x^2 + N_y^2 + N_z^2} = 100$					



Load factors and angular accelerations specified above are inertia load factors and angular accelerations acting at the CG of the weapon. The maximum value will be attained in not less than 0.03 second.

Sign convention -- all load factors and angular acceleration are positive as shown.

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Reliability Requirements

[redacted] Fuze functional reliability is assumed to mean reliability of the bomb at the target, excluding LASL nuclear components, but including the parachute system.

Continuity monitoring shall not be required immediately prior to takeoff. [redacted]

Logistic Requirements

The weapon shall be designed to be safe, easy to assemble, store, transport, and test.

CHAPTER II -- WEAPON DESCRIPTION

DOE (b)

General

[redacted] The complete bomb designed for B-47 and B-52 application weighs approximately 8850 pounds, is 50 inches in diameter, is 144 inches long (148 inches long at the peak of the automatic deployment closing cover).

The TX-53 bomb is composed of the TX-53 basic assembly and the TX-53 bomb shape components. T capability to assemble bomb shape components and the basic assembly into the bomb configuration and then to reconvert to the two previous configurations has been achieved in the design.

The TX-53 bomb (see Figure 1) consists of:

1. The TX-53 basic assembly.
2. The TX-53 bomb shape components.
   a. The automatic deployment cover.
   b. The rear case section.
   c. The parachute assembly with stowage can.
   d. The fins.
   e. The outer case segment system (cylindrical panels).
   f. The energy-absorbing nose assembly and nose fairing.
   g. The deformation switch.
   h. The cables and miscellaneous hardware.

<u>TX-53 Basic Assembly</u>

The TX-53 basic assembly consists of five principal items (see Figure 2):

1. The basic subassembly.
2. The end ca[redacted]
3. The [redacted]
4. The electrical component mounting ring assembly.
5. The closing plate.

DOE (b)(3)

The MC-1202 is a two-channel motor-driven switch housed in a sealed aluminum case. Each channel consists of a 12-volt DC motor which operates through a gearbox to drive an aluminum camshaft. [redacted]

MC-1312 Option Baro

The MC-1312 option baro (see Figure 28) completes the circuits between the MC-1262 fast rise thermal batteries and the MC-1202 option switch motors. [redacted]

The MC-1312 is a low-volume, four element baro. [redacted]

MC-1315 Parachute Timer

Two MC-1315 timers (see Figure 29) are used to complete the circuits between the MC-1262 fast-rise batteries and the parachute deployment systems. These circuits are completed 1 to 1.14 seconds after the MC-1315 receives a pulse from the pulse generators in the MC-1200. The MC-1315 is a spring-wound escapement timer initiated by an MC-727 explosive motor. The MC-1315 has dual channel switching; therefore, each of the two MC-1315 timers connects both fast-rise batteries to the dual channel deployment systems.

MC-1262 Fast Rise Thermal Battery

Two MC-1262 fast rise thermal batteries (see Figure 30) are used in the TX-53 weapon system. The MC-1262 is a two-section thermal battery containing a 12-volt fast rise section and a 28-volt power section. Basically, it is two batteries in a single case with a common negative terminal. [redacted]

Electrical connections to the MC-1262 are made through the SA-870-1 sealed connector. The 12-volt section of the battery is designed to activate quickly and furnish short duration pulse currents. The 28-volt section is designed for slower activation and delivery of a high current for a relatively longer time.

MC-1203 Interconnecting Box

The MC-1203 interconnecting box (see Figure 31) is a pigtail type interconnecting box which completes the circuits between components in the aircraft monitor and control system and the parachute deployment systems. [redacted] release, the MC-1315 timer contacts close, completing the circuits between the MC-1282 fast rise thermal battery and the appropriate MC-1060 detonators in the automatic parachute deployment systems. At the same time, a signal is provided from the MC-1315 through the MC-1202 to cut the retardation parachute suspension lines, and the following parachute deployment sequence occurs (see Figure 35).

1. The automatic deployment cover is separated from the rear case section by the MDF system.
2. The automatic deployment cover deploys the pilot chute.
3. The pilot chute deploys the retardation chute.
4. The retardation chute, which has been cut loose from the retardation chute lugs, deploys the laydown parachute system.

The laydown parachute system is required to decelerate the weapon to a vertical terminal velocity of 55 fps maximum and limits the attitude angle of the longitudinal axis of the weapon to within 10 degrees of vertical at the time of impact. Upon impact, the kinetic energy is converted into work when the aluminum honeycomb in the energy-absorbing nose is crushed at a uniform load of approximately 70 g's. If a windy condition exists at the target, the weapon will have horizontal velocity as well as vertical velocity. At impact the weapon will topple, causing a secondary impact to occur. The aluminum honeycomb components (fins, rear case section, parachute stowage can, and outer case segments) deform to absorb the secondary impact energy and limit the loads to no more than 100 g's laterally within the basic assembly. All of the fuzing and firing components employed in the laydown option are housed within the basic case and are designed to withstand the 100-g impact shock load.

[redacted]

DSWA b(1) b(3) DOE

High Altitude Delivery

If the weapon has been delivered from above 22,000 feet mean sea level, the MC-1312 option baroswitch contacts are closed, completing the circuit between the MC-1282 fast rise battery and the MC-1202 option switch.

The 22,000-foot minimum altitude was established by adding the sum of the deviations caused by baro-sensing errors and meteorological prediction errors to the upper operational limit of the MC-1312 option baro. Less than one second after release of the weapon the MC-1202 option switch operates to the high-level option. One second after release, the MC-1315 timer completes the circuits between the MC-1282 fast rise

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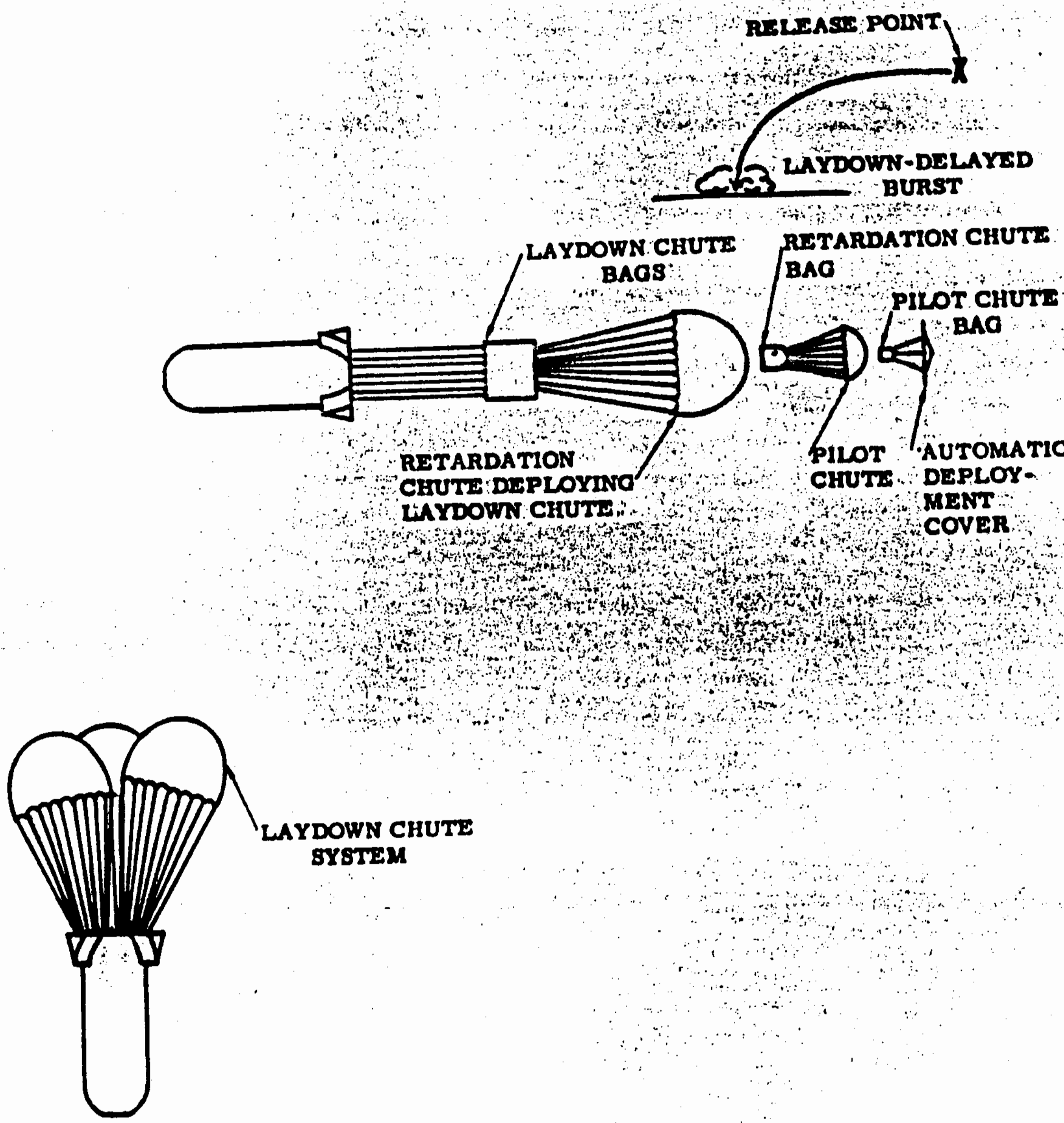

Figure 35. Laydown Option Deployment Sequence

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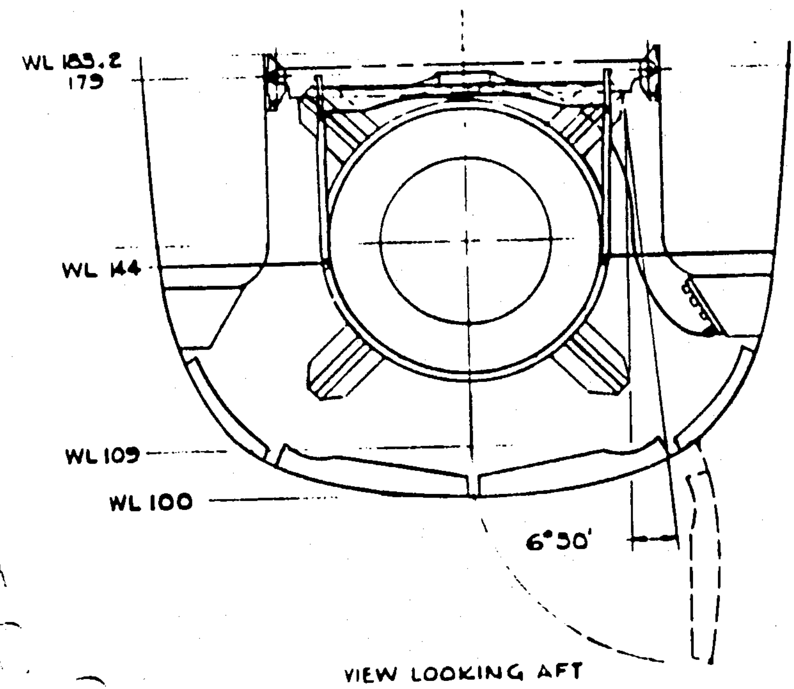

TX-53 in B-52 Bomb Bay

dual carriage is permissible. Either bomb may be released first. As illustrated in Figure 41, adequate fall clearances have been preserved and maximum parachute volume has been attained by the design of the tent-shaped automatic deployment cover. Dual carriage and fall clearance of the TX-53 from either B-52 bomb bay dictated the shape of the automatic deployment cover. Other weapon types have been dual-carried with the TX-53 in the B-52 during the development drop test program.

An extensive fly-around test is scheduled to demonstrate the compatibility of the TX-53 with the B-52H aircraft. Compatibility of the TX-53 with the B-52 test aircraft has been demonstrated by two laydown and sixteen high altitude drop test operations.

Aircraft Monitor and Control System

The TX-53 is compatible with the T-240 or T-249A aircraft monitor and control system and the T-380 peace/readiness switch used in the B-47 and B-52 aircraft. Compatibility has been demonstrated by the fuzing and firing drop tests reported in Chapter III conducted with T-249 or T-249A equipped aircraft.

Safety

Accidental detonation of the TX-53 is prevented by a series of safing devices which can be categorized as follows:

1. Manually set
2. Remotely set
3. Environment sensing

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TO: N. E. Bradbury, Director, Los Alamos Scientific Laboratory, Los Alamos, New Mexico
James W. McRae, President, Sandia Corporation
Attn: R. W. Henderson

Date: Sep 23 1958

FROM: Ralph P. Johnson, Assistant Manager for Manufacturing, ALOO

SUBJECT: CLASS C LAYDOWN WEAPON (FUFO)

SYMBOL: MPP:AOM

DOE b(3)

By SRD memorandum, Starbird/Hertford, subject: [redacted] Laydown Weapon", symbol: MAR:MRR, dated September 2, 1958, copies to Sandia Corporation and LASL, ALO is requested to advise DMA scheduling possibilities and the estimated OAD for a Class C Laydown Weapon.

An estimated timetable, based on the time that will be required to complete design, development, testing and first production for this program is requested.

This information is desired by October 15, 1958. If this date cannot be met ALO should be advised as to when a response can be expected.

Distribution:

1A - N. E. Bradbury, Dir., LASL, Los Alamos, New Mexico
2A & 3A - James W. McRae, Pres., SC, Attn: R. W. Henderson
4A - J. V. Durant, Br. Ch., Ofc. of Mfg., #2
5A - Manufacturing Files
6A & 7A - Central Files

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